Aug. 30, 1966 O. J. ALBRECHT 3,269,626

ADJUSTABLE SUPPORT FOR PRESSURE FIXING ROLLERS

Filed March 27, 1964

Fig. 1

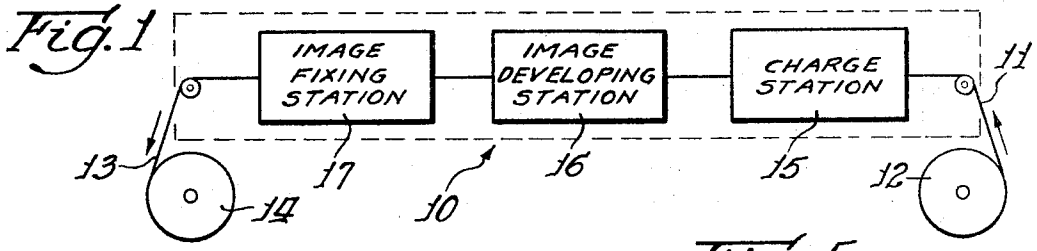


Fig. 2

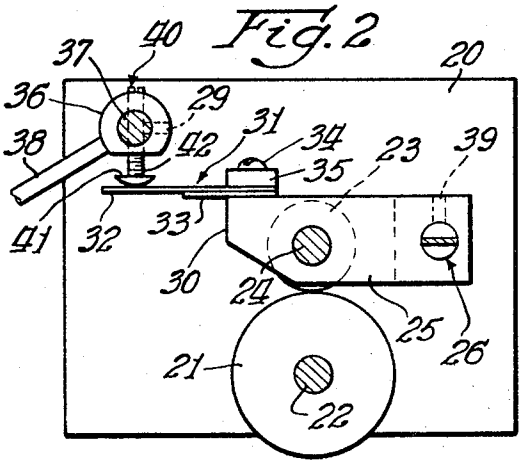


Fig. 5

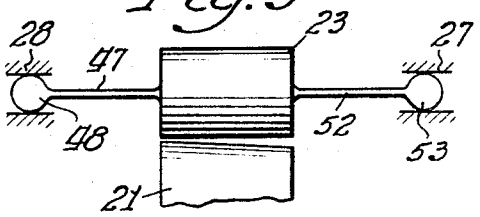


Fig. 6

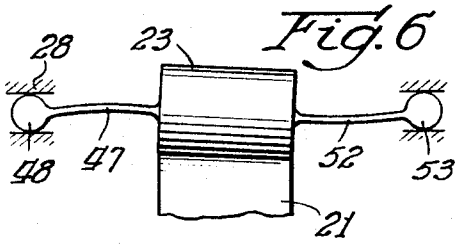


Fig. 3

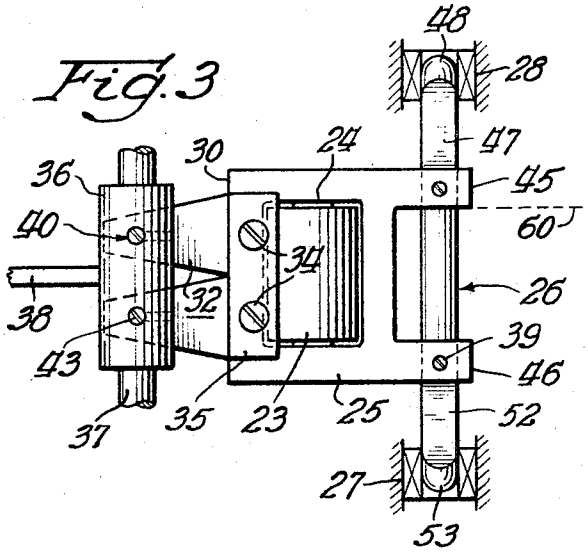
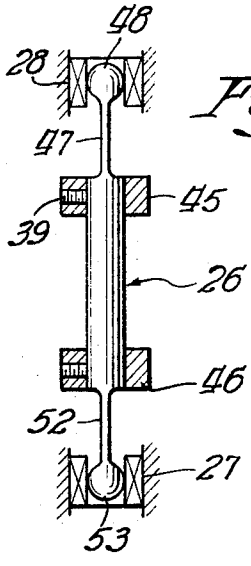


Fig. 4



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ADJUSTABLE SUPPORT FOR PRESSURE FIXING ROLLERS

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This invention is directed to an adjustable support for pressure fixing rollers in an electrostatic printing system, and more particularly to such a support system which provides a permanent, visible record on a flexible tape from a temporary but visible image represented by the adherence of conductive, opaque particles to discretely charged areas on the tape.

The progress of the computer arts has been such that the speed of computer operation now greatly exceeds the rate at which information can be fed into, and processed out of, the computer. Accordingly substantial efforts have been directed to increasing the efficiency and operating speed of those components which feed data into, and read the processed data out of, the computer itself. One significant improvement has been the production of electrostatic recording equipment, in which information is placed on a flexible tape by selectively charging different areas of the tape. The resultant latent image is rendered visible by passing the selectively charged tape through a mass of conductive opaque particles which adhere to the charged areas. The developed image is permanently fixed by the application of heat, pressure, solvent, or some combination of these or other techniques, to produce a permanent visible record of the information received from the computer or other data source.

Pressure fixing is frequently utilized with electrostatic printing systems to obviate stickiness or undesired adherence of the tape to the system elements, which may be caused by the use of heat and/or solvent fixing techniques. However there have been various shortcomings, even with pressure fixing systems, such as the need for precise alignment between the spaced-apart rollers which apply the pressure to the "inked" tape. The initial roller alignment is frequently lost after some hours of operation, because of the frequent engagement and disengagement of the rollers for loading and unloading the system, together with the relatively high pressure exerted between the rollers. In addition, tapes of different widths have been used in various systems, making it difficult to obtain a fixing pressure distributed evenly across the tapes of different widths.

It is, therefore, a primary object of the present invention to provide an improved pressure fixing arrangement in which an even and sure alignment between the rollers is provided initially, and is maintained with only minimum adjustment thereafter.

Another object of the invention is the provision of such a pressure fixing arrangement in which means are provided for simply and accurately presetting the pressure which will be applied to tapes of different widths, and distributed uniformly across the tape width.

The foregoing and other objects of the invention are realized, in one embodiment, by providing a pressure fixing arrangement which includes first and second rollers, positioned to either side of the tape path. Also provided is means, which may include a support frame, for supporting one of the rollers for movement toward and away from the other roller. In accordance with a salient aspect of the present invention, such means includes a novel pivot element or shaft of given cross section in a direction substantially normal to the direction of such movement, and a reduced cross section in a direction substantially parallel the direction of roller movement. This

construction maintains alignment of the rollers as one roller is brought into engagement with the other roller. In addition, some "give" or flexure is afforded by the pivot element being reduced in cross-section along the direction of such flexure. Thus, a good contact between the two rollers is always assured, not only when the equipment is set up during manufacture, but also over the life of the equipment.

In accordance with another aspect of the invention, resilient biasing means may be provided to urge one of the rollers toward the other with the requisite level of pressure. To accommodate tapes of different widths, the biasing means may comprise two separate elements, individually adjustable to correspondingly regulate the pressure applied across two portions of one roller. The lateral extent of at least one biasing element is at least equal to the width of the most narrow tape to be used in the system, so that the pressure adjustment of the second biasing element can be varied with respect to that of the first to produce an even pressure across the entire tape width.

To enable those skilled in the art to practice the invention, the best mode contemplated for making and using the invention will now be described in connection with the accompanying drawing, in the several figures of which like reference numerals identify like elements, and in which:

FIGURE 1 is a block diagram of an electrostatic printing arrangement in which the present invention finds utility;

FIGURE 2 is a simplified front view of a pressure fixing arrangement constructed in accordance with the inventive teaching;

FIGURE 3 is a top view of the embodiment depicted in FIGURE 2;

FIGURE 4 is a partial side view of the structure shown in FIGURES 2 and 3, useful in understanding an important aspect of the present invention; and

FIGURES 5 and 6 are illustrative showings, similar to side views of the indicated components, but omitting portions of the support frame **25**, for purposes of clarity in illustrating the flexing action of the outer portions of pivot shaft **26**, useful in understanding the operation of the present invention.

General system

As shown in FIGURE 1, an electrostatic printer **10** may be used to process a blank tape **11** drawn off a supply reel **12**, to provide a visible and permanent image on the processed tape **13** which is wound on a take-up reel **14**. A recorder or printing unit **10** in general comprises three sub-assemblies: a charge station **15**, in which discrete areas of the flexible web are selectively charged to represent an information pattern; an image developing station **16** in which conductive opaque particles are attracted to the charged areas of the tape to "develop" the latent information pattern; and an image fixing station **17** in which the temporarily visible pattern is fixed to produce a permanent record of the information originally deposited on the tape at charge station **15**. With this general perspective of the system, image fixing station **17** will now be considered.

Pressure fixing arrangement

As shown in FIGURE 2, a pressure fixing station **17** is affixed to a panel **20**, which may be a portion of the front panel of an electrostatic printer. The fixer arrangement comprises a first roller **21** journalled on a shaft **22**, which extends through panel **20** and is mounted in suitable bearings to be driven by a motor (neither the bearings nor the motor are indicated, in that their mounting and operation are well known) whenever the electrostatic print-

er is energized. Accordingly, to fix the temporarily visible image on the tape, it is necessary to force a second roller **23** toward roller **21**, to provide a compressive force of a level sufficient to effect the pressure fixing operation. Pressure roller **23** is journalled on a shaft **24**, in its turn supported in a first end portion of frame member **25** positioned substantially normal to front panel **20**. Frame member **25** includes a second end portion journalled on a shaft or pivot element **26** received in bearings **27** and **28** (FIGURES 3–6), but the bearing support is omitted to more clearly portray the inventive structure. A pair of set screws **39** are provided to lock shaft **26** tightly to support frame or carrier **25**. It is thus apparent that support frame **25** can pivot about shaft **26**, responsive to the selective application and removal of forces to the other end **30** of support frame **25**.

A cantilever spring assembly **31** including a pair of bias elements or springs **32** and a second pair of shorter springs **33** is affixed by a pair of screws **34** and a fastening plate **35** to end portion **30** of support frame **25**. A rotatable, generally circular member **36** may be formed as a part of, or mounted on, a shaft **37** which is journalled in bearings (not shown) in front panel **20**, to afford angular displacement of member **36** responsive to forces selectively applied to a handle member **38** affixed to member **36** by screwing into a correspondingly tapped aperture in member **36**, or affixed by other suitable means. A pair of adjusting members **40** are provided, each of which has a spherical head portion **41** and a threaded body portion **42** which is received in a correspondingly tapped bore of member **36**. A slot **43** is provided in the upper end of each member **40**, to permit angular rotation of the member and a corresponding linear adjustment of the position of head portion **41** with respect to the surface of spring **32** when member **36** is in the position depicted in FIGURE 2. A pair of nylon-tipped set screws **29** provide for selective locking of adjustment members **40** in position. The entire assembly of component **36** and its associated elements, together with springs **31** affixed to the left end of frame member **25**, can be considered as a biasing means for effecting the engagement of pressure roller **23** with main drive roller **21**.

From inspection of FIGURE 2, it will be apparent that upon effecting angular displacement of handle **38** in a clockwise or counter-clockwise direction, the head portions **41** of adjusting elements **40** will also be displaced in a like direction, out of engagement with the surfaces of springs **32**, to remove the bias force from frame member **25**. In a related manner, the compressive force between rollers **23** and **21** can be restored by displacement of handle **38** in the counterclockwise or clockwise direction, to again engage extremities **41** with springs **32**.

Certain of the components depicted in FIGURE 2 are also shown in FIGURE 3. The slots **43** for positioning adjusting members **40** are visible above the extensions of leaf spring surfaces **32**.

In the right-hand portion of FIGURE 3, support frame **25** is shown to have a pair of support areas or arms **45** and **46** in which the center portion of shaft **26** is received. The diameter of the center of shaft **26**, where it is received in the bores of support portions **45** and **46**, is such that the shaft is tightly fitted to support frame **25** and set screws **39** lock the shaft to carrier **25**. This construction assures that the rear portion of support frame **25** will always be in precise alignment with the center portion of shaft **26**. Shaft **26** also includes a first outer leg portion **47**, terminating in an end portion **48** which is received within a bearing member **28**. The bearing support is not indicated in the drawing. In like manner, the other extremity of shaft **26** includes an outer leg portion **52** terminating in a rounded end portion **53**, which is received in a bearing unit **27** supported within a bearing support (not shown) in conventional manner.

It is noted that outer leg portions **47** and **52** of shaft **26** are of substantially the same cross section as the central portion in a plane, or in a direction, substantially perpendicular to the direction of relative displacement between pressure roller **23** and main drive roller **21**.

FIGURE 4 illustrates a salient aspect of the present invention, emphasizing the substantially reduced cross section of outer leg portions **47** and **52** in a direction substantially parallel the direction of relative displacement between roller **23** and roller **21**. By providing a solid central portion on shaft **26** received within bore or bearing portions **45** and **46** of the support frame, support frame **25** is aligned with the central portion of shaft **26**. However, by providing a reduced cross section in outer leg portions **47** and **52** in the direction of flexure of support frame **25**, unbalances of fixing pressure and/or surface irregularities of either roller **23** or **21** which might otherwise cause unsatisfactory operation of the system, are precluded from adversely affecting the pressure-fixing operation.

The improved operation, and sureness of roller alignment, is best described in connection with FIGURES 5 and 6. Assuming, for purposes of explanation, that main drive roller **21** is out of round, at least along one surface (as indicated in FIGURE 5 in greatly exaggerated form), without the reduced-section outer legs of this invention, it would be expected that as pressure roller **23** were displaced into engagement with main drive roller **21**, the left portions would engage and compress the tape therebetween, but effective pressure fixing would not be accomplished in the right hand portion of this assembly. However, in accordance with the inventive teaching and as particularly illustrated in FIGURE 6, the reduced cross-section outer legs of shaft **26** "give" or flex as the rollers are urged into engagement, thus to enable roller **23** to be aligned substantially flush with the adjacent surface of main drive roller **21** and ensure an effective pressure fixing operation across the complete lateral dimension of the tape as it passes between the rollers. This improved structure not only minimizes the time and expense required to effect the original alignment of the pressure fixing arrangement, but also provides for a long, trouble-free life of the equipment without constant attention to the critical relationship between these two rollers.

Another important aspect of the present invention is the ease and precision with which the system is compensated to provide an even pressure distribution across the width of the tape, especially when the system is changed over from operation with tape of a first width to tape of a second width. For example, tape widths may vary from one-quarter inch to one and one-quarter inches in the lateral dimension.

Referring again to FIGURE 3, it is noted that the positions of members **40** can be adjusted by inserting a screwdriver or similar tool into slots **43** and effecting rotation of members **40**, to correspondingly vary the level of the bias force transmitted over springs **32** to frame **25** and roller **23**. The alignment means (not shown) for maintaining the tape in the proper position for fixing retains the tape with the inner tape edge always at the same position with respect to the front panel **20**; such tape edge is coincident with broken line **60** shown in FIGURE 3. With the illustrated configuration, the upper one of the bias surfaces **32** (FIGURE 3) is arranged to transmit a force distributed evenly across the complete tape when the tape is of minimum width. The lower adjusting spring **32** is then regulated to provide a bias force which, when distributed across the remainder of the tape, will provide a substantially equal compressive force across the remainder of the mating surfaces between rollers **23** and **21**. By way of example, if a tape of one inch width were used, it is assumed that the three-quarter inch segment of the tape nearer to front panel **20** would be compressed by the force transmitted over upper spring **32**. This adjustment is made in the manner described above, by inserting a tool such as a screwdriver in slot **43** and adjusting the position of the upper member **40** to effect the

requisite force of a reference level transmitted over upper spring **32**. A corresponding adjustment is then made to effect the transmission of a force one-third the reference level over the lower one of springs **32**, in that this force will be applied to compress a one-quarter inch width of tape, only a third the lateral extent of the tape compressed by the force transmitted over the upper one of springs **32**.

By readily accommodating tapes of various widths in the pressure fixer, considerable flexibility of this portion of the system is realized, and there is no restriction imposed on the overall system by the construction and operation of the pressure fixing stage.

By way of example, and in no sense by way of limitation, dimensions of a pivot element **26** successfully employed in practice of the invention are set out below. The overall shaft length was 2.5", and the center portion of the shaft, including those portions received in support arms **45** and **46** of the support frame, was 1.625". The diameter of this center portion of pivot element **26**, as well as the generally spherical outer portions **48** and **53**, was 0.3125". The extent of the reduced cross section outer portions **47** and **52** was 0.150".

While only a particular embodiment of the invention has been described and illustrated, it is manifest that various modifications and alterations may be made therein. It is, therefore, the intention in the appended claims to cover all such modifications and alterations as may fall within the true spirit and scope of the invention.

What is claimed is:

1. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path; and

means for supporting one of said rollers for movement toward and away from the other of said rollers, including a shaft element comprising at least a portion which has a cross section of given dimension in a direction substantially normal to the direction of such movement, and a cross section smaller than said given dimension in a direction substantially parallel to the direction of movement, thereby accommodating irregularities in the roller surfaces and ensuring uniform pressure application between the rollers to provide uniform fixing of the image on the flexible tape.

2. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path; and

means for supporting one of said rollers for movement toward and away from the other of said rollers, including a pivot element having a central portion with a cross section of given uniform dimension, and a pair of outer portions coaxial with said central portion, each outer portion having a cross section smaller than said given dimension in a direction substantially parallel to the direction of roller movement, thereby accommodating irregularities in the roller surfaces and ensuring uniform pressure application between the rollers to provide uniform fixing of the image on the flexible tape.

3. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path;

a support frame, having a first end portion for supporting one of said rollers for movement toward and away from the other of said rollers, and a second end portion for receiving a pivot element; and

a pivot element having a central portion with a cross section of given uniform dimension positioned within the second end portion of the support frame, and having a pair of outer portions each with a cross section smaller than said given dimension in a direction substantially parallel to the direction of roller movement, thereby accommodating irregularities in the roller surfaces and ensuring uniform pressure application between the rollers to provide uniform fixing of the image on the flexible tape.

4. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is diplaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned below the tape path;

a second roller positioned above the tape path;

a support frame, having a first end portion for supporting one of said rollers for movement toward and away from the other of said rollers, and a second end portion for receiving a pivot element; and

a pivot element having a central portion with a cross section of given uniform dimension positioned within the second end portion of the support frame, a pair of outer portions each with a cross section smaller than said given dimension in a direction substantially parallel to the direction of roller movement, and a pair of generally spherical bearing portions, one affixed to the extremity of each outer portion of the pivot element, thereby accommodating irregularities in the roller surfaces and ensuring uniform pressure application between the rollers to provide uniform fixing of the image on flexible tape.

5. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a main drive roller positioned below the tape path;

a pressure roller positioned above the tape path;

a support frame, having a first end portion for supporting the pressure roller for movement toward and away from the main drive roller, and a second portion for receiving a pivot element;

first and second bearing supports, each spaced at a distance from, and aligned with, said second end portion of the support frame; and

a pivot element having a central portion with a cross section of given uniform dimension positioned within the second end portion of the support frame, and having a pair of outer portions each with a cross section smaller than said given dimension in a direction substantially parallel to the direction of roller movement, each outer portion terminating in a generally spherical bearing portion which is received in one of said bearing supports, thereby accommodating irregularities in the roller surfaces and ensuring uniform pressure application between the rollers to provide uniform fixing of the image on the flexible tape.

6. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is diplaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second rolled positioned to the other side of the tape path;

means for supporting one of said rollers for movement relative to the other of said rollers, including a pivot element having a cross section of given dimension in a direction substantially normal to the direction of such movement, and a cross section smaller than said

given dimension in a direction substantially parallel to the direction of movement; and

resilient biasing means comprising at least two elements, each element being individually adjustable to regulate the fixing pressure across a portion of the tape, thereby to provide a uniform fixing pressure for tapes of different widths.

7. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path;

means for supporting one of said rollers for movement relative to the other of said rollers, including a pivot element having a cross section of given dimension in a direction substantially normal to the direction of such movement, and a cross section smaller than said given dimension in a direction substantially parallel to the direction of movement;

biasing means comprising first and second resilient elements; and

at least two adjusting elements, one adjusting element positioned to engage the first resilient element and regulate the bias force applied across a first lateral portion of the area between the rollers, and the other adjusting element positioned to engage the second resilient element and regulate the bias force applied across a second lateral portion of the area between the rollers, thereby to provide a uniform fixing pressure for tapes of different widths.

8. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path;

means for supporting one of said rollers for movement relative to the other of said rollers, to provide a compressive force along a lateral area between the rollers; and

a single resilient biasing assembly comprising at least two integral elements, one of said elements being individually adjustable to regulate the compressive force only across a first portion of the lateral area and the other of said elements being individually adjustable to regulate the compressive force only across the remaining portion of said lateral area, thereby to provide a uniform fixing pressure for tapes of different widths.

9. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path;

means for supporting one of said rollers for movement relative to the other of said rollers, to provide a compressive force along a lateral area between the rollers;

a single biasing assembly, including first and second integral spring elements, positioned so that the first spring element applies a compressive force only along a first portion of said lateral area and so that the second spring element applies a compressive force only along the remaining portion of said lateral area;

a first adjusting means disposed to regulate the force applied by the first spring element; and

a second adjusting means disposed to regulate the force applied by the second spring element, thus to provide a uniform fixing pressure across said lateral area as tapes of different widths are used in the system.

10. In an electrostatic printing system in which a flexible tape having conductive particles adhering to individually charged areas is displaced along a given path, a pressure-fixing arrangement comprising:

a first roller positioned to one side of the tape path;

a second roller positioned to the other side of the tape path;

a frame member for supporting one of said rollers for movement relative to the other of said rollers, to provide a compressive force along a lateral area between the rollers;

a first cantilever type spring having first and second end portions, said first end portion being secured to one end of the frame member;

a second cantilever type spring having first and second end portions, said first end portion being secured to said one end of the frame member;

shaft means having a central body portion spaced from the second end portion of each cantilever type spring;

a first adjusting element, having a threaded body portion received in said shaft means and a head portion engaging the second end portion of the first cantilever type spring, the position of the first adjusting element in the shaft means determining the level of the bias force applied over the frame member to a first portion of the lateral area between the rollers;

a second adjusting element, having a threaded body portion received in said shaft means and a head portion engaging the second end portion of the second cantilever type spring, the position of the second adjusting element in the shaft means determining the level of the bias force applied over the frame member to a second portion of the lateral area between the rollers; and

means for rotating said shaft means to effect the engagement and disengagement of the adjusting elements with the cantilever type springs.

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